CLAIMS

What is claimed is:

1. A system for the reception and despreading of a direct-sequence spread-spectrum (DSSS) signal, said system comprising:

an antenna array configured to receive said DSSS signal and comprising a plurality of antenna elements;

a preprocessor coupled to said antenna array and configured to preprocess said DSSS signal in the time domain to produce a time-domain (TD) DSSS signal stream;

a time-to-frequency-domain (TFD) transformer coupled to said preprocessor and configured to transform said TD DSSS signal stream from the time domain to the frequency domain to produce a frequency-domain (FD) DSSS signal stream;

a beam former coupled to said TFD transformer, configured to form a reception beam in said DSSS signal, and configured to produce a beamed signal stream in the frequency domain from said FD DSSS signal stream;

a despreader coupled to said beam former and configured to despread said beamed signal stream in the frequency domain to produce an FD despread signal stream; and

a frequency-to-time-domain (FTD) transformer coupled to said despreader and configured to transform said FD despread signal stream from the frequency domain to the time domain to produce a received signal stream.

2. A system as claimed in claim 1 wherein said DSSS signal is a code-division multiple access global positioning system signal.

3. A system as claimed in claim 1 wherein:

each of said antenna elements is configured to receive said DSSS signal as an DSSS elemental signal; and

for one of said antenna elements, said preprocessor comprises:

a digitizer coupled to said one antenna element and configured to down convert and digitize said DSSS elemental signal received by said one antenna element into an DSSS adjusted signal; and

a memory coupled to said digitizer and configured to produce a portion of said TD DSSS signal stream from said DSSS adjusted signal.

4. A system as claimed in claim 3 wherein said digitizer comprises:

an analog-to-digital (A/D) converter coupled to said one antenna element and configured to convert said DSSS elemental signal into a DSSS digitized signal; and

a digital down converter coupled to said A/D converter and configured to down convert said DSSS digitized signal into said DSSS adjusted signal.

5. A system as claimed in claim 4 wherein:

said digital down converter converts said DSSS digitized signal into a DSSS baseband signal; and

said digitizer additionally comprises a presummer coupled to said digital down converter and configured to produce said DSSS adjusted signal from said DSSS baseband signal.

6. A system as claimed in claim 3 wherein:

said digitizer additionally comprises an analog down converter coupled to said one antenna element and configured to down convert said DSSS elemental signal into a DSSS converted signal; and

said A/D converter is coupled to said analog down converter and configured to convert said DSSS converted signal into said DSSS digitized signal.

7. A system as claimed in claim 3 wherein said memory is a multi-access memory.

8. A system as claimed in claim 7 wherein said multi-access memory comprises a plurality of ping-pong random-access memories.

9. A system as claimed in claim 3 wherein:

said memory is configured to partition said DSSS adjusted signal derived from said one antenna element into a plurality of DSSS signal-stream segments; and

said preprocessor additionally comprises a multiplexer coupled to said memory and configured to route said DSSS signal-stream segments derived from said one antenna element to produce said TD DSSS signal stream.

10. A system as claimed in claim 1 wherein:

said system additionally comprises a coefficient generator configured to provide a coefficient stream; and

said beam former is coupled to said TFD transformer and said coefficient generator and is configured to produce said beamed signal stream from said FD DSSS signal stream in response to said coefficient stream.

11. A system as claimed in claim 10 wherein said coefficient generator comprises a memory configured to buffer beam coefficients for said reception beam to produce said coefficient stream.

12 A system as claimed in claim 10 wherein said coefficient generator comprises:

a multiplier configured to combine beam coefficients and filter coefficients for said reception beam to produce said coefficient stream; and

a memory coupled to said multiplier and configured to buffer said coefficient stream.

13. A system as claimed in claim 10 wherein said beam former comprises:

a multiplier coupled to said TFD transformer and said coefficient generator, and configured to combine said FD DSSS signal stream with said coefficient stream to produce a plurality of partial-beam signal streams; and

an accumulative adder coupled to said multiplier and configured to sum said plurality of partial-beam signal streams to produce said beamed signal stream.

14. A system as claimed in claim 1 wherein:

said TFD transformer is a first TFD transformer;

said system additionally comprises:

a despread-code generator configured to provide a TD despread code for said DSSS signal in the time domain; and

a second TFD transformer coupled to said despread-code generator and configured to transform said TD despread code from the time domain to the frequency domain to produce an FD despread code; and

said despreader is coupled to said beam former and said second TFD transformer and is configured to despread said beamed signal stream into said FD despread signal stream in response to said FD despread code.

15. A system as claimed in claim 14 wherein said despread-code generator comprises:

a code oscillator configured to produce a code clock; and

a code generator coupled to said code oscillator and configured to generate said TD despread code in response to said code clock.

16. A system as claimed in claim 14 wherein:

said despread-code generator is configured to provide a plurality of said TD despread codes in the time domain;

said second TFD transformer is configured to transform said plurality of TD despread codes from the time domain to the frequency domain to produce a plurality of said FD despread codes;

said despreader is configured to despread said beamed signal stream into said FD despread signal stream in response to said plurality of FD despread codes; and

said despread-code generator comprises:

a plurality of code oscillators and configured to produce a plurality of code clocks; and

a plurality of code generators configured to generate a said plurality of TD despread codes, wherein each of said code generators is coupled to one of said code oscillators and is configured to produce one of said TD despread codes in response to one of said code clocks.

17. A system as claimed in claim 14 wherein said despreader comprises a multiplier configured to despread said beamed signal stream in response to said FD despread code to produce said FD despread signal stream.

18. A system as claimed in claim 1 wherein:

said FDT transformer produces a TD despread signal stream; and

said system additionally comprises a postprocessor coupled to said FDT transformer and configured to postprocess said TD despread signal stream in the time domain to produce said received signal stream.

19. A system as claimed in claim 18 wherein said postprocessor comprises a doppler compensator configured to effect doppler compensation of said TD despread signal stream in the time domain to produce said received signal stream.

20. A method of receiving a direct-sequence spread-spectrum (DSSS) signal, said method comprising:

receiving said DSSS signal at each of a plurality of antenna elements in an antenna array, wherein each of said plurality of antenna elements receives said DSSS signal as one of a plurality of DSSS elemental signals;

preprocessing each of said plurality of DSSS elemental signals in the time domain to produce a time-domain (TD) DSSS signal stream;

transforming said TD DSSS signal stream from the time domain to the frequency domain to produce a frequency-domain (FD) DSSS signal stream;

forming a reception beam for said DSSS signal in the frequency domain to produce a beamed signal stream;

despreading said beamed signal stream in the frequency domain to produce an FD despread signal stream; and

transforming said FD despread signal stream from the frequency domain to the time domain to produce a TD despread signal stream.

21. A method as claimed in claim 20 wherein said preprocessing activity comprises:

digitizing said plurality of DSSS elemental signals to produce a plurality of DSSS digitized signals, wherein each of said DSSS digitized signals is derived from one of said DSSS elemental signals;

down converting said plurality of DSSS digitized signals to produce a plurality of DSSS baseband signals, where each of said DSSS baseband signals is derived from one of said DSSS digitized signals; and

fracturing said plurality of DSSS baseband signals into a plurality of groups of DSSS signal-stream segments, wherein each of said groups of DSSS signal-stream segments is derived from one of said DSSS baseband signals, and wherein each of said DSSS signal-stream segments is a portion of said TD DSSS signal stream.

22. A method as claimed in claim 21 wherein said preprocessing activity additionally comprises multiplexing said DSSS signal-stream segments to produce said TD DSSS signal stream.

23. A method as claimed in claim 21 wherein:

said preprocessing activity additionally comprises, prior to said digitizing activity, down converting said plurality of DSSS elemental signals to produce a plurality of DSSS converted signals, wherein each of said DSSS converted signals is derived from one of said DSSS elemental signals; and

said digitizing activity digitizes said plurality of DSSS converted signals.

24. A method as claimed in claim 20 wherein said forming activity comprises:

generating a coefficient stream comprising beam coefficients for said reception beam;

mixing said FD DSSS signal stream and said coefficient stream to form a plurality of partial-beam signal streams; and

accumulatively summing each of said plurality of partial-beam signal streams to produce a plurality of beamed signal streams.

25. A method as claimed in claim 20 wherein said generating activity comprises mixing said beam coefficients with filter coefficients for said reception beam to form said coefficient stream.

26. A method as claimed in claim 20 wherein said despreading activity comprises:

generating a TD despread code for said DSSS signal in the time domain;

transforming said TD despread code from the time domain to the frequency domain to produce an FD despread code; and

multiplying said beamed signal streams by said FD despread code in the frequency domain to produce said FD despread signal stream.

27. A method as claimed in claim 20 wherein said despreading activity comprises:

generating a plurality of TD despread codes for said DSSS signal in the time domain;

transforming said TD despread codes from the time domain to the frequency domain to produce a plurality of FD despread codes; and

multiplying said beamed signal streams by said FD despread codes in the frequency domain to produce said FD despread signal stream.

28. A method as claimed in claim 20 additionally comprising postprocessing said TD despread signal stream to produce a received signal stream.

29. A method as claimed in claim 28 wherein said postprocessing activity comprises compensating said TD despread signal stream for doppler effects.

30. A system for the reception and despreading of a direct-sequence spread-spectrum (DSSS) signal, said system comprising:

an antenna array configured to receive said DSSS signal and comprising a plurality of antenna elements, wherein each of said antenna elements is configured to receive said DSSS signal as a DSSS elemental signal;

a plurality of analog-to-digital (A/D) converters, wherein each of said A/D converters is coupled to one of said antenna elements and is configured to digitize said DSSS elemental signal received thereby to produce a DSSS digitized signal;

a plurality of multi-access memories, wherein each of said multi-access memories is coupled to one of said digital down converters and is configured to partition said DSSS digitized signal down converted thereby to produce a TD DSSS signal stream;

a first time-to-frequency-domain (TFD) transformer coupled to said preprocessor and configured to transform said TD DSSS signal stream from the time domain to the frequency domain to produce a frequency-domain (FD) DSSS signal stream;

a coefficient generator configured to merge beam coefficients and filter coefficients for a reception beam in said DSSS signal to produce a coefficient stream;

a beam former coupled to said TFD transformer and said coefficient generator, configured to said reception beam, and configured to produce a beamed signal stream in the frequency domain from said FD DSSS signal stream in response to said coefficient stream;

a despread-code generator configured to provide a plurality of TD despread codes for said DSSS signal in the time domain;

a second TFD transformer coupled to said despread-code generator and configured to transform said plurality of TD despread codes from the time domain to the frequency domain to produce a plurality of FD despread codes;

a despreader coupled to said beam former and said second TFD transformer, and configured to despread said beamed signal stream

in the frequency domain in response to said plurality of FD despread codes to produce an FD despread signal stream; and

a frequency-to-time-domain (FTD) transformer coupled to said despreader and configured to transform said FD despread signal stream from the frequency domain to the time domain to produce a received signal stream.